

1D HETEROSTRUCTURES BASED ON NANOTUBE TEMPLATES: CONFINEMENT OF 6T MOLECULES INSIDE BNNT FOR POLARIZED LIGHT EMISSION.

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Single walled carbon nanotubes (SWCNTs) have been used as a 1D template for assembling various molecules and inorganic compounds into well-defined shapes, thanks to their hollow, crystalline and cylindrical architectures.

In the context of fluorescent molecules assembly, it was unfortunately demonstrated that the overlap of the emission bands of the adsorbed dyes with the absorption bands of semiconducting nanotubes in the visible range (2-3 eV) leads to effective energy transfers that both readily quench the dyes fluorescence and sensitize the nanotube host. As an alternative, boron nitride nanotubes (BNNT) have been identified as a promising host template for fluorescent molecules because of their dielectric nature with wide-gap semiconductors of ~5.5 eV, opening the way for the design of fluorescent nano-hybrids.¹

In this presentation we will focus on the impact of local order and stacking configuration of sexithiophene (6T) dyes confined inside BNNTs on the polarization properties of the fluorescence of the 6T: Combining ac-HRTEM and polarized fluorescence imaging on individual BNNT, we show that the fluorescence from the 6T assembly is stable and strongly polarized with extinction ratios as high as 700 at room temperature.² A statistical analysis of the 6T orientations inside BNNTs with inner diameter up to 1.5 nm shows that 80% of the encapsulated 6Ts exhibit a maximum deviation angle of less than 10° with respect to the BNNT axis.

Furthermore, our results reveal that the BNNT wall drives the alignment of the 6T by preferential adsorption in the competition molecule-molecule and molecule-BNNT interactions.

Finally, we show that the polarization properties at the nanoscale in 6T@BNNT can be expanded in thin films based on aligned 6T@BNNT inside polymeric matrix.

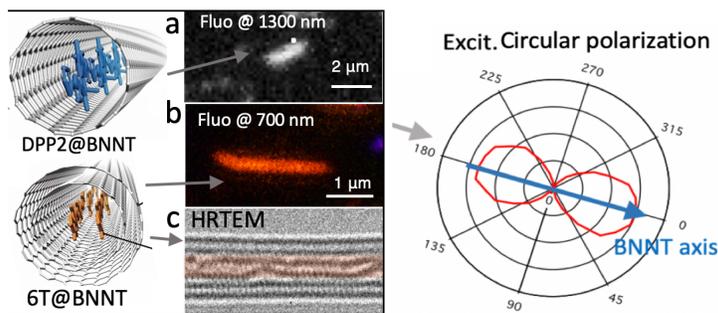


Figure 1 : right (a-b) NIR bio-nanoprobes fluorescence pattern based on Dyes@BNNT. (c) Aberration corrected HRTEM image of a 6T@BNNT heterostructure. Left. Polarized fluorescence patterned from 10³ molecules confined and aligned inside a BNNT

References

[1] C. Allard, *Advanced Materials*, 8 (2020)

[2] A. Badon, ArXiv, (2022)